PA . .NT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 23 July 1997 (23.07.97)	
International application No. PCT/US96/19213	**Applicant's or agent's file reference** SYTRON-001
International filing date (day/month/year) 03 December 1996 (03.12.96)	**Priority date** (day/month/year) 04 December 1995 (04.12.95)
Applicant CHEN, Min et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   03 July 1997 (03.07.97)

   [ ] in a notice effecting later election filed with the International Bureau on:

   _____

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Ting Zhao
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G01T 1/00, 1/29

A1

(11) International Publication Number: WO 97/21114

(43) International Publication Date: 12 June 1997 (12.06.97)

(21) International Application Number: PCT/US96/19213

(22) International Filing Date: 3 December 1996 (03.12.96)

(30) Priority Data:

60/007,969	4 December 1995 (04.12.95)	US
60/012,116	13 May 1996 (13.05.96)	US

(71) Applicant *(for all designated States except US)*: SYNCROTRONICS, INC. [US/US]; 111 Yarmouth Road, Brookline, MA 02167 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: CHEN, Min [US/US]; 111 Yarmouth Road, Brookline, MA 02167 (US). CHOUVALOV, Roudolf S. [RU/RU]; 18-142 Lenin Street, Protvino, Moscow Region, 142284 (RU). GOLOVKINE, Serguei Vasilievich [RU/RU]; Apartment 297, 24B Lenina Street, Protvino, Moscow Region, 142284 (RU). SOKOLOV, Skiff [RU/RU]; Apartment 18, 3 Moscow Street, Protvino, Moscow Region, 142284 (RU).

(74) Agents: RICCI, Christopher, P. et al.; Sullivan & Worcester L.L.P., One Post Office Square, Boston, MA 02109 (US).

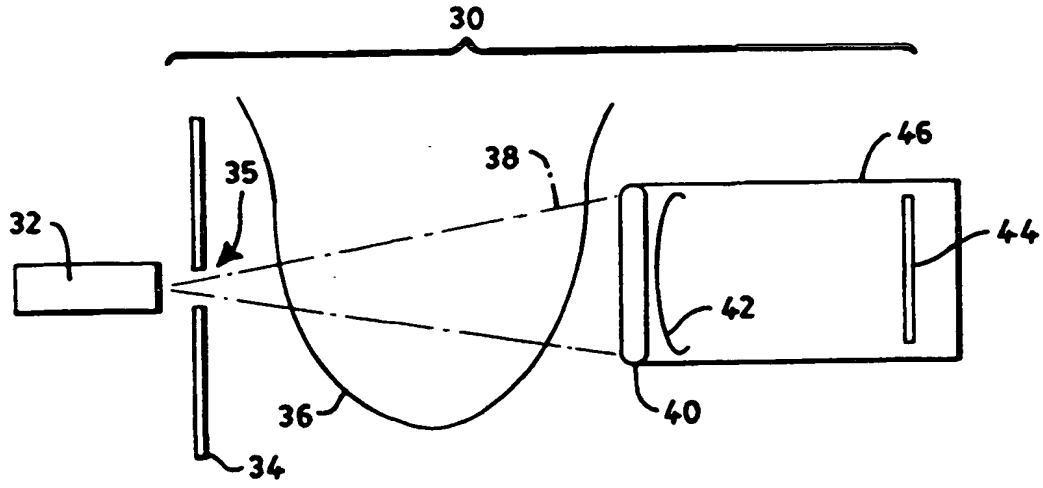
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: PRECISION IMAGING SYSTEM



(57) Abstract

An imaging system is disclosed for use in low-light environments or environments where low-levels of such radiation is desirable. Examples of such environments are night photography, laparoscopy, and mammography. In the case of radiation that is other than visible light, a radiation converter and method for fabricating same is disclosed. The radiation converter comprises a film of heavy scintillator (e.g. CdWO4) coated on a fiber optical window to efficiently convert the radiation into visible light. The visible light is passed into a signal amplifier employing an electron-bombarded charge-couple device (EBCCD) to amplify the signal. Novel methods of performing three-dimension imaging using this system as well as removing the effects of high speed movement are also disclosed.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/US 96/19213

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01T1/00 G01T1/29

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G01T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 0 714 038 A (LORAL FAIRCHILD CORP ;UNIV MASSACHUSETTS MEDICAL (US)) 29 May 1996 see abstract see column 1, line 4 - column 2, line 12 see column 3, line 1 - line 12 see column 4, line 49 - column 5, line 16 see column 6, line 54 - column 7, line 26 see column 8, line 50 - column 9, line 4 see figures --- -/--	1-3,5,6, 8,12-15, 29,30, 33,35, 36,39, 41,42

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 April 1997	16.04.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Datta, S

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 11461 A (CAMBRIDGE IMAGING LTD ;PACKARD INSTRUMENT CO INC (US); RUSHBROOKE) 27 April 1995	1,2,5,6, 8,12-15, 35,36, 38,41,42
Y	see abstract see page 5, line 1 - line 13 see page 6, line 22 - page 7, line 15 see page 8, line 1 - page 11, line 15 see page 49, line 6 - page 56, line 19 see figures	9,10, 18-20,23
X	US 4 995 396 A (INABA, MAKOTO ET AL.) 26 February 1991 see column 7, line 44 - line 66 see column 12, line 14 - column 14, line 2 see column 15, line 47 - column 18, line 39 see column 19, line 51 - column 20, line 24 see column 25, line 46 - column 26, line 9 see figures	1,2,5,6, 8,12,15, 24-26,29
X	WO 94 03108 A (SLOAN KETTERING INST CANCER) 17 February 1994 see abstract see page 7, line 12 - line 37 see page 8, line 19 - line 27 see page 11, line 4 - page 13, line 11 see page 17, line 17 - line 26 see figures 1,2	1,2,5,6
Y	DE 34 37 203 A (SIEMENS AG) 17 April 1986 see page 2, line 6 - page 4, line 22; figures	9,10, 18-20,23
A	EP 0 274 775 A (PHILIPS NV) 20 July 1988 see abstract see page 3, line 44 - page 4, line 48 see figures	27,28
A	NUCLEAR INSTRUMENTS AND METHODS IN PHYSICS RESEARCH, vol. A339, 1994, NORTH HOLLAND, pages 449-455, XP000430086 CIANFARANI C ET AL.: "A HIGH RESOLUTION DETECTOR BASED ON LIQUID CORE SCINTILLATING FIBRES WITH READOUT VIA AN ELECTRON -BOMBARDED CHARGE- COUPLED-DEVICE" see page 449 - page 452	1,12,13

INTERNATIONAL SEARCH REPORT

information on patent family members

Intern[illegible]cation No
PCT/US 96/19213

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0714038 A	29-05-96	CA 2161465 A	26-05-96
		JP 8289883 A	05-11-96
WO 9511461 A	27-04-95	AU 7944394 A	08-05-95
		DE 4497968 T	05-12-96
		EP 0724730 A	07-08-96
		GB 2289333 A	15-11-95
US 4995396 A	26-02-91	JP 2174838 A	06-07-90
WO 9403108 A	17-02-94	US 5325855 A	05-07-94
		AU 4795693 A	03-03-94
DE 3437203 A	17-04-86	NONE	
EP 0274775 A	20-07-88	NL 8603059 A	01-07-88
		CA 1284239 A	14-05-91
		DE 3778677 A	04-06-92
		JP 63149772 A	22-06-88
		US 4870692 A	26-09-89

Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An imaging system for capturing an image from image-bearing radiation, the imaging system comprising:

a camera housing;

optic means disposed within the camera housing for collecting the image-bearing radiation and defining an optical path;

an image amplifier disposed within the camera housing along the optical path such that image amplifier electronically amplifies the image in the image-bearing radiation; and

a detector disposed in the optical path, the detector being adapted to convert the image into an electronic signal representative of the image.

2. The imaging system according to claim 1 further comprising a scintillator converts the radiation into a visible light spectrum.

3. The imaging system according to claim 2 wherein the scintillator converts x-ray radiation.

4. The imaging system according to claim 2 wherein the scintillator converts ultra-violet radiation.

5. The imaging system according to claim 1 further comprising display means in electrical communication with the detector for receiving the electronic signal and displaying the image transmitted thereby.

6. The imaging system according to claim 1 wherein the image amplifier further comprises a photocathode which translates the image-bearing radiation into electron emissions.

7. The imaging system according to claim 6 wherein the photocathode is fabricated of gallium-arsenide to convert infrared radiation into the electron emmissions.

8. The imaging system according to claim 6 wherein the detector is an Intensified Charge-Coupled Device.

9. The imaging system according to claim 1 further comprising a radiation source that projects radiation toward an object creating the image-bearing radiation from the object, the radiation source being adapted to electronically shifts between a plurality of positions of the radiation such that the image transmitted by the image-bearing radiation changes for each of the plurality of positions.

10. The imaging system according to claim 9 wherein the radiation source electronically shifts between two positions generating stereo-pairs of three-dimensional images.

11. The imaging system according to claim 1 wherein color images are created by filtering the image-bearing radiation consecutively through a plurality of filters thus creating a plurality of sub-images, the imaging system further comprising processing means for correcting motion in the color images by correcting and correlating the plurality of sub-images.

12. A medical imaging system for detecting abnormalities in tissue, the medical system comprising:

a radiation source that projects radiation into the tissue, the radiation being selectively absorbed by the tissue thereby imparting an image onto the radiation defining a radiation shadow.

a radiation converter in optical alignment with the radiation source, the radiation converter converting the radiation shadow, and thus the image transmitted thereby, into image-bearing visible light; and

a photosensitive medium in optical communication with the radiation converter such that the image-bearing visible light generates and image of the tissue and abnormalities therein.

13. The medical imaging system according to claim 12 further comprising a photocathode disposed between the radiation converter and the photosensitive medium where the photocathode converts image-bearing visible light into an electron stream which is projected onto the photosensitive medium.

14. The medical imaging system according to claim 13 wherein the photosensitive medium is an Intensified Charge-Coupled Device.

15. The imaging system according to claim 1 wherein the radiation converter comprises:

a scintillator that converts the radiation shadow into the image-bearing visible light; and

optical transmission means in optical communication with the scintillator for transmitting the image-bearing visible light to the photosensitive medium.

16. The medical imaging system according to claim 15 wherein the scintillator has a density of at least 6 grams per cubic centimeter.

17. The medical imaging system according to claim 15 wherein the scintillator is fabricated of cadmium tungsten oxide or lutetium oxyorthosilicate.

18. The medical imaging system according to claim 12 wherein the radiation source is selectively movable to project the radiation between a plurality of positions such that the radiation shadow changes for each of the plurality of positions.

19. The medical imaging system according to claim 18 wherein the radiation source electronically shifts between two positions generating stereo-pairs of three-dimensional images.

20. The medical imaging system according to claim 18 wherein the radiation source is continuously deflected producing a plurality of radiation shadows that can be interactively "focused" to various levels within the tissue.

21. The medical imaging system according to claim 18 further comprising processing means for differentiating between foreground and background in the plurality of radiation shadows such that the background can be subtracted from the image.

22. The medical imaging system according to claim 21 wherein the processing means is adapted to replaced the background with a second background.

23. The medical imaging system according to claim 18 wherein the radiation source projects divergent rays of the radiation.

24. The medical imaging system according to claim 12 wherein color images are created by filtering the image-bearing radiation consecutively through a plurality of filters thus creating a plurality of sub-images, the imaging system further comprising processing means for correcting motion in the color images by removing blur and correlating the sub-images.

25. The medical imaging system according to claim 12 wherein the radiation source projects white light and the detector is disposed opposed to the radiation source with the tissue interposed therebetween.

26. The medical imaging system according to claim 12 wherein the radiation source projects white light which is reflected from the tissue, the medical imaging system further comprising fiber optic means for collecting the white light reflected from the tissue and communicating the white light to the detector.

27. A method of correcting for motion in an image generated by capturing two or more consecutive sub-images, the method comprising the steps of :

calculating amplitudes of low harmonics of a first image of the two or more consecutive sub-images;

mapping a coordinate transformation of first image into a second image of the two or more consecutive sub-images;

computing corresponding transformations of the two or more consecutive sub-images by interpolation; and

reconstructing the image from the two or more consecutive sub-images.

28. The method according to claim 26 further comprising the step of establishing a pixel-to-pixel correspondence by computing interpolated pixel values.

29. A detector for use in an electronic imaging system comprising an active area divided into a plurality of rows and columns where each of the plurality of rows is adapted to be independently shifted up or down.

30. The detector according to claim 29 wherein the detector incorporates Multi-Pinned Phase (MPP) technology to reduce dark current.

31. The detector according to claim 29 wherein the detector is chemically etched in an isotropic etching solution in a rotating disc system.

32. The detector according to claim 29 further comprising field means for generating a stable electric field proximal to a back-side surface of the detector.

33. The detector according to claim 29 wherein the field means is dynamically selectable to adjust demagnification of the detector so as to govern a area of an abject to be imaged

34. The detector according to claim 29 wherein the detector has a stable "dead layer" created by ion implantation.

35. A method for fabricating a radiation converter having a high resolution, the method comprising:

attaching a scintillator to a light guide; and

machining a surface of the scintillator to a predetermined thickness.

36. The method according to claim 35 wherein the scintillator has a high density.

37. The method according to claim 36 wherein the scintillator has a density of at least about 8 grams/cm^3.

38. The method according to claim 35 wherein the scintillator is machined to the predetermined thickness of approximately 50 microns thickness.

39. The method according to claim 35 wherein the scintillator is fabricated of cadmium tungsten oxide.

40. The method according to claim 35 wherein the scintillator is fabricated of lutetium oxyorthosilicate.

41. The method according to claim 35 wherein the light guide is fiber optic.

42. The method according to claim 35 wherein the light guide has a top surface to which the scintillator is attached and the top surface is substantially planar.

20

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416)
SYTRON-001		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US96/19213	03/12/1996	04/12/1995
International Patent Classification (IPC) or national classification and IPC		
G01T1/00		
Applicant		
SYNCROTRONICS, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03/07/1997	12.03.98
Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Mielke, W Telephone No. (+49-89) 2399-2661

Form PCT/IPEA/409 (Cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US96/19213

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-33	as originally filed			

Claims, No.:

1-13	as received on	05/03/1998	with letter of	05/03/1998

Drawings, sheets:

1/9-9/9	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-13
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

see separate sheet

Item V:

The EBCCD of claim 1 is given in figure 2 on page 451 of the paper of C.Cianfarini et al. To use it with a solid radiation bearing detector seems to be obvious, because such a detector is common in the art and there seem to exist no prejudices against such an application. But with this obvious combination a system of claim 1 is achieved. The additional features of claims 2-13 seem to be well known in the art. Thereby a shifting is indicated in figure 2 of DE-A1-3437203; claims 9,10. Because of the time pressure it seems appropriate to regard claims 1-13 not to meet the criterion of article 33(3) PCT.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

Min Chen
Syncrotronics Corp.
111 Yarmouth Road
Brookline, MA 02167
USA

EINSCHREIBEN

COMMUNICATION IN CASES FOR WHICH NO OTHER FORM IS APPLICABLE

	Date of mailing (day/month/year) 10.08.98
Applicant's or agent's file reference SYTRON-001	REPLY DUE See paragraph 1 below
International application No. PCT/US 96/ 19213	International filing date (day/month/year) 03/12/1996
Applicant SYNCROTRONICS, INC. et al.	

1. ☐ REPLY DUE within _____ , months/days from the above date of mailing

   ☐ NO REPLY DUE

2. COMMUNICATION:

With reference to your fax letter of 29 July,1998 please find attached a copy of the nternational Preliminary Examination Report concerning the above mentioned application.

Please note that according to our records this document was sent to your representives n Boston on 12 March 1998.

Name and mailing address of the IPEA/	Authorized officer

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

RICCI, Christopher P.
Sullivan & Worcester LLP
One Post Office Square
Boston, MA 02109
ETATS-UNIS D'AMERIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)* 12.03.97	
Applicant's or agent's file reference SYTRON-001	IMPORTANT NOTIFICATION
International application No. PCT/US96/19213	International filing date *(day/month/year)* 03/12/1996
	Priority date *(day/month/year)* 04/12/1995
Applicant SYNCROTRONICS, INC. et al.	

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416)
SYTRON-001		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US96/19213	03/12/1996	04/12/1995
International Patent Classification (IPC) or national classification and IPC		
G01T1/00		
Applicant		
SYNCROTRONICS, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   I ☒ Basis of the report
   II ☐ Priority
   III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   IV ☐ Lack of unity of invention
   V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   VI ☐ Certain documents cited
   VII ☐ Certain defects in the international application
   VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03/07/1997	
Name and mailing address of the IPEA/	Authorized officer

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US96/19213

Cover sheet (examiner version, for internal use only)

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US96/19213	03/12/1996	04/12/1995

International Patent Classification (IPC) or both national Classification and IPC

G01T1/00

Applicant

SYNCROTRONICS, INC. et al.

1. ☒ This report is accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of **4** sheets.

2. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Art. 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

Mielke, W
Authorized officer

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US96/19213

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-33	as originally filed				

Claims, No.:

1-13	as received on	05/03/1998	with letter of	05/03/1998	

Drawings, sheets:

1/9-9/9	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-13
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations

see separate sheet

Item V:

The EBCCD of claim 1 is given in figure 2 on page 451 of the paper of C.Cianfarini et al. To use it with a solid radiation bearing detector seems to be obvious, because such a detector is common in the art and there seem to exist no prejudices against such an application. But with this obvious combination a system of claim 1 is achieved. The additional features of claims 2-13 seem to be well known in the art. Thereby a shifting is indicated in figure 2 of DE-A1-3437203; claims 9,10. Because of the time pressure it seems appropriate to regard claims 1-13 not to meet the criterion of article 33(3) PCT.

3 The imaging system (80), shown in Fig.7, according to claim1 comprising

a solid radiation bearing detector (40), which is a flexible optic light guide system (92, 82 and 88) made of many tiny about 5 micro-meter diameter fibers, and a light source (90) thereby creating image bearing radiation (110) from the reflected light from object (84); and

a photocathode (102), shown in Figs. 7 and 8, which converts the radiation bearing light (110), reflected from object (84) and transmitted through fiber optic light guide system (92, 82 and 88), into streams of electrons (116), which can be gated according to their arrival time at the high voltage electrodes (112),

An image amplifier (112, 114) disposed in the stream of electrons (116) such that image amplifier (112, 114) electrostatically accelerates or decelerates the stream of electrons (116) according to their arrival time; and

an amplified detector (96) disposed after the image amplifier (112, 114) and, upon input of the stream of electrons (116), being adapted to generate secondary electrons to further amplify the image represented thereby such that the amplified detector (96) then converts secondary electrons into an electronic signal representative of the image.

4. The imaging system (80) according to claim 3 wherein the photocathode (102) is fabricated of gallium-arsenide, which converts the infrared radiation bearing light (110), reflected from object (84) and transmitted through fiber optic light guide system (92, 82 and 88), into streams of electrons (116), which are gated according to their arrival time at the high voltage electrodes (112), to analyze the time dependent images at detector (96), after an initial flash from the light source (90) has been emitted and reflected.

5. The imaging system (80) according to claim 3 wherein the image amplifier (112, 114) is adapted to selectively electronically magnify the image-bearing radiation (110) as measured at detector (96) and thus adjust a resolution of the image.

Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An imaging system (46), shown in Fig. 3, which defines an optical path therein, for capturing an image from the image-bearing radiation (38), the imaging system comprising:

a solid radiation bearing detector (40) disposed in the optical path adapted to convert the image-bearing radiation (38) into converted radiation;

a photocathode (42, 102), shown in Figs. 3 and 8 respectively, disposed within the camera housing (94) along the optical path to convert the converted radiation into a stream of electrons (116) representative of the image-bearing radiation (38);

an image amplifier (112, 114) disposed in the stream of electrons (116) such that image amplifier (112, 114) electrostatically accelerates the stream of electrons (116); and

an amplified detector (96) disposed after the image amplifier (112, 114) and, upon input of the stream of electrons (116), being adapted to generate secondary electrons to further amplify the image represented thereby such that the amplified detector (96) then converts secondary electrons into an electronic signal representative of the image

2. A radiation imaging system (30), shown in Fig. 3, comprising

a radiation source (32) that projects radiation (35) toward an object (36),

thereby creating image-bearing radiation (38) from the object (36) toward the imaging system (46); and

an imaging system (46), which according to claim 1 has a solid

radiation bearing detector (40), shown in Fig. 4, comprising a scintillator (50) which converts the image-bearing radiation (38) into a visible light spectrum (116)

6 The imaging system (80) according claim 5 wherein the image amplifier (112, 114) is dynamically selectable to adjust magnification so as to govern an area of an object (84) to be imaged.

7 The imaging system (46) according to claim 2 wherein the image amplifier (112, 114) is adapted to selectively electronically de-magnify the image-bearing radiation (38) and thus adjust a resolution of the image.

8 The imaging system (46) according claim 7 wherein the image amplifier (112, 114) is dynamically selectable to adjust de-magnification so as to govern an area of an object (36) to be imaged.

9. The radiation imaging system (30), shown in Fig. 6, according to claim 2 wherein the radiation source (62) is adapted to electronically shift between a plurality of dynamically selectable positions (66,68) such that the image transmitted by the image-bearing radiation (74,76) changes for each of the plurality of positions.

10. The radiation imaging system (30) according to claim 9 wherein the radiation source (62) electronically shifts between two dynamically selectable positions (66, 68) to generate stereo pairs of three-dimensional images and to select the line-of-view of an object of interest to bypass other shadowing objects.

11. The radiation imaging system (30) according to claim 9 wherein the radiation source is continuously deflected producing a plurality of radiation shadows that can be interactively "focused" to various levels within the object (36, 84)

12. The radiation imaging system (30) according to claim 9 wherein the radiation source projects divergent rays of the radiation and has a spot size smaller than a resolution of the radiation imaging system (30).

13. The imaging system (46) according to claim 1 further comprising:

filtering means for filtering the image-bearing radiation (38) consecutively through a plurality of filters (40) thus creating a plurality of sub-images,

analysis means to distinguish between the changes of sub-images due to the filtering of the radiation and due to the object motion during and between the exposures, and

filtering means for filtering the image-bearing radiation

consecutively through a plurality of wavelength filters (40) which allows only light within a preselected ranges of wavelength to pass, so that a "colored" image can be formed using these subimages of different wavelength,

analysis means to distinguish between the changes of sub-images due to the filtering of the light of different wavelength and due to the object motion during and between the exposures, and

correcting means for correcting the changes of the plurality of sub-images due to the object motion and correlating the plurality of sub-images into a color image (Fig. 10).

Claim 13 to 20 & 37 lost

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
SYTRON-001		
International application No.	International filing date (day/month/year)	(Earliest) Priority Date (day/month/year)
PCT/US 96/ 19213	03/12/1996	04/12/1995
Applicant		
SYNCROTRONICS, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (see Box I).

2. [ ] **Unity of invention is lacking** (see Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing

   [ ] filed with the international application.

   [ ] furnished by the applicant separately from the international application,

      [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

   [ ] Transcribed by this Authority

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:

   Figure No. 3

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [X] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

Interna[redacted] Application No
PCT/[redacted] 96/19213

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01T1/00 G01T1/29

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G01T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 0 714 038 A (LORAL FAIRCHILD CORP ;UNIV MASSACHUSETTS MEDICAL (US)) 29 May 1996 see abstract see column 1, line 4 - column 2, line 12 see column 3, line 1 - line 12 see column 4, line 49 - column 5, line 16 see column 6, line 54 - column 7, line 26 see column 8, line 50 - column 9, line 4 see figures --- -/--	1-3,5,6, 8,12-15, 29,30, 33,35, 36,39, 41,42

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
10 April 1997	16. 04. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Datta, S

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 11461 A (CAMBRIDGE IMAGING LTD ;PACKARD INSTRUMENT CO INC (US); RUSHBROOKE) 27 April 1995	1,2,5,6, 8,12-15, 35,36, 38,41,42
Y	see abstract see page 5, line 1 - line 13 see page 6, line 22 - page 7, line 15 see page 8, line 1 - page 11, line 15 see page 49, line 6 - page 56, line 19 see figures	9,10, 18-20,23
X	US 4 995 396 A (INABA, MAKOTO ET AL.) 26 February 1991 see column 7, line 44 - line 66 see column 12, line 14 - column 14, line 2 see column 15, line 47 - column 18, line 39 see column 19, line 51 - column 20, line 24 see column 25, line 46 - column 26, line 9 see figures	1,2,5,6, 8,12,15, 24-26,29
X	WO 94 03108 A (SLOAN KETTERING INST CANCER) 17 February 1994 see abstract see page 7, line 12 - line 37 see page 8, line 19 - line 27 see page 11, line 4 - page 13, line 11 see page 17, line 17 - line 26 see figures 1,2	1,2,5,6
Y	DE 34 37 203 A (SIEMENS AG) 17 April 1986 see page 2, line 6 - page 4, line 22; figures	9,10, 18-20,23
A	EP 0 274 775 A (PHILIPS NV) 20 July 1988 see abstract see page 3, line 44 - page 4, line 48 see figures	27,28
A	NUCLEAR INSTRUMENTS AND METHODS IN PHYSICS RESEARCH, vol. A339, 1994, NORTH HOLLAND, pages 449-455, XP000430086 CIANFARANI C ET AL.: "A HIGH RESOLUTION DETECTOR BASED ON LIQUID CORE SCINTILLATING FIBRES WITH READOUT VIA AN ELECTRON -BOMBARDED CHARGE- COUPLED-DEVICE" see page 449 - page 452	1,12,13

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Application No PCT/[redacted] 96/19213

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0714038 A	29-05-96	CA 2161465 A	26-05-96
		JP 8289883 A	05-11-96
WO 9511461 A	27-04-95	AU 7944394 A	08-05-95
		DE 4497968 T	05-12-96
		EP 0724730 A	07-08-96
		GB 2289333 A	15-11-95
US 4995396 A	26-02-91	JP 2174838 A	06-07-90
WO 9403108 A	17-02-94	US 5325855 A	05-07-94
		AU 4795693 A	03-03-94
DE 3437203 A	17-04-86	NONE	
EP 0274775 A	20-07-88	NL 8603059 A	01-07-88
		CA 1284239 A	14-05-91
		DE 3778677 A	04-06-92
		JP 63149772 A	22-06-88
		US 4870692 A	26-09-89

PATENT COOPERATION TREATY

REC'D 30 OCT 1998
WIPO PCT

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (PCT/IPEA/416)
SYTRON-001		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US96/19213	03/12/1996	04/12/1995
International Patent Classification (IPC) or national classification and IPC		
G01T1/00		
Applicant		
SYNCROTRONICS, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 5 sheets.

CORRECTED VERSION

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☒	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03/07/1997	28. 10. 98
Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Mielke, W Telephone No. (+49-89) 2399-2661

Form PCT/IPEA/409 (Cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US96/19213

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-33	as originally filed				

Claims, No.:

1-20	as received on	01/10/1998	with letter of	26/09/1998	

Drawings, sheets:

1/9-9/9	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-20
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Point V:

Thank you for your letter of 26 September 1998 accompanied by copies of your letter of 4 March 1998 and claims 1-20 on pages 34-38.
Basis for the wrong report of 12 March 1998 was the first fax of 5 March 1998 with page 37 missing in our file. I overlooked this as well as the mentioning of pages 34-38 and claims 20,14,15 in your letter of 4 March 1998. I am very sorry for these faults and apologize for any inconveniences caused. The fax of second time of 5 March 1998 is even worse in our file, and the confirmation by express mail bears a receiving signature M 10.03.98, while the report left my desk on 6 March 1998, because our internal time limit is 4 March 1998, and I received the file on 6 March 1998.

The EBCCD of claim 1 is given in figure 2 on page 451 of the paper of C.Cianfarani et al. To use it with a solid radiation bearing detector seems to be obvious, because such a detector is common in the art and there seem to exist no prejudices against such an application. But with this obvious combination a system of claim 1 is achieved.

To arrive at a compact instrument the solid radiation bearing detector would be arranged directly upon the fibre optic window of the above mentioned figure 2 (claim 2). With a sensibility of EBCCD's to X-rays either a flexible optic light guide has to be chosen or well known high density scintillators would be used (claims 3,19). For IR radiation gallium-arsenide is a well known photocathode (claim 4) and the magnification teachings in claims 5-8 seem to be usual in the art. A source stereo shifting is indicated in figure 2 of DE-A1-3437203 (claims 9-12) and subimages with filters are necessary and usual in the art (claim 13). Again motion corrections e.g. by subtraction procedures seem to be usual in the art, EP-A1-274775 page 2 lines 26-39, (claims 14-16). For X-rays an additional dead layer seems to be necessary to avoid a wrong exposure (claim 17), and the optic means of claim 18 are known in the form of a fibre optic window from figure 2 on page 451 of the paper of C.Cianfarani et al. In claim 20 filtering means similar to the one of claim 13 are indicated which seem to be necessary and usual in the art.

Accordingly it seems appropriate to regard claims 1-20 not to meet the criterion of article 33(3) PCT.

Point VIII:

The mentioning of figures in claims 1-3,9 seems not to be absolutely necessary. Article 6 and rule 6.2(a) PCT.

Claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An imaging system (46), shown in Fig. 3, which defines an optical path therein, for capturing an image from the image-bearing radiation (38), the imaging system comprising:

a solid radiation bearing detector (40) disposed in the optical path adapted to convert the image-bearing radiation (38) into converted radiation;

a photocathode (42, 102), shown in Figs. 3 and 8 respectively, disposed within the camera housing (94) along the optical path to convert the converted radiation into a stream of electrons (116) representative of the image-bearing radiation (38);

an image amplifier (112, 114) disposed in the stream of electrons (116) such that image amplifier (112, 114) electrostatically accelerates the stream of electrons (116); and

an amplified detector (96) disposed after the image amplifier (112, 114) and, upon input of the stream of electrons (116), being adapted to generate secondary electrons to further amplify the image represented thereby such that the amplified detector (96) then converts secondary electrons into an electronic signal representative of the image.

2. A radiation imaging system (30), shown in Fig. 3, comprising

a radiation source (32) that projects radiation (35) toward an object (36),

thereby creating image-bearing radiation (38) from the object (36) toward the imaging system (46); and

an imaging system (46), which according to claim 1 has a solid

radiation bearing detector (40), shown in Fig. 4, comprising a scintillator (50) which converts the image-bearing radiation (38) into a visible light spectrum (116)

AMENDED SHEET

3. The imaging system (80), shown in Fig. 7, according to claim 1 comprising

a solid radiation bearing detector (40), which is a flexible optic light guide system (92, 82 and 88) made of many tiny about 5 micro-meter diameter fibers, and a light source (90) thereby creating image bearing radiation (110) from the reflected light from object (84); and

a photocathode (102), shown in Figs. 7 and 8, which converts the radiation bearing light (110), reflected from object (84) and transmitted through fiber optic light guide system (92, 82 and 88), into streams of electrons (116), which can be gated according to their arrival time at the high voltage electrodes (112),

An image amplifier (112, 114) disposed in the stream of electrons (116) such that image amplifier (112, 114) electrostatically accelerates or decelerates the stream of electrons (116) according to their arrival time; and

an amplified detector (96) disposed after the image amplifier (112, 114) and, upon input of the stream of electrons (116), being adapted to generate secondary electrons to further amplify the image represented thereby such that the amplified detector (96) then converts secondary electrons into an electronic signal representative of the image.

4. The imaging system (80) according to claim 3 wherein the photocathode (102) is fabricated of gallium-arsenide, which converts the infrared radiation bearing light (110), reflected from object (84) and transmitted through fiber optic light guide system (92, 82 and 88), into streams of electrons (116), which are gated according to their arrival time at the high voltage electrodes (112), to analyze the time dependent images at detector (96), after an initial flash from the light source (90) has been emitted and reflected.

5. The imaging system (80) according to claim 3 wherein the image amplifier (112, 114) is adapted to selectively electronically magnify the image-bearing radiation (110) as measured at detector (96) and thus adjust a resolution of the image.

AMENDED SHEET

6. The imaging system (80) according claim 5 wherein the image amplifier (112, 114) is dynamically selectable to adjust magnification so as to govern an area of an object (84) to be imaged.

7. The imaging system (46) according to claim 2 wherein the image amplifier (112, 114) is adapted to selectively electronically de-magnify the image-bearing radiation (38) and thus adjust a resolution of the image.

8. The imaging system (46) according claim 7 wherein the image amplifier (112, 114) is dynamically selectable to adjust de-magnification so as to govern an area of an object (36) to be imaged.

9. The radiation imaging system (30), shown in Fig. 6, according to claim 2 wherein the radiation source (62) is adapted to electronically shift between a plurality of dynamically selectable positions (66,68) such that the image transmitted by the image-bearing radiation (74,76) changes for each of the plurality of positions.

10. The radiation imaging system (30) according to claim 9 wherein the radiation source (62) electronically shifts between two dynamically selectable positions (66, 68) to generate stereo pairs of three-dimensional images and to select the line-of-view of an object of interest to bypass other shadowing objects.

11. The radiation imaging system (30) according to claim 9 wherein the radiation source is continuously deflected producing a plurality of radiation shadows that can be interactively "focused" to various levels within the object (36, 84).

12. The radiation imaging system (30) according to claim 9 wherein the radiation source projects divergent rays of the radiation and has a spot size smaller than a resolution of the radiation imaging system (30).

13. The imaging system (46) according to claim 1 further comprising:

filtering means for filtering the image-bearing radiation (38) consecutively through a plurality of filters (40) thus creating a plurality of sub-images,

analysis means to distinguish between the changes of sub-images due to the filtering of the radiation and due to the object motion during and between the exposures, and

correcting means for correcting the changes of the plurality of sub-images due to the object motion and correlating the plurality of sub-images into a color image.

14. The radiation imaging system (30) according to claim 2 wherein the imaging system (30) corrects for motion in a color image generated by capturing two or more consecutive sub-images, the imaging system (30) further comprising:

calculation means for calculating the shift vector between the two or more consecutive sub-images, using lists of characteristic quantities computed from the images;

mapping means for mapping a coordinate transformation of first image into a second image of the two or more consecutive sub-images;

computing means for computing corresponding transformations of the two or more consecutive sub-images by interpolation; and reconstruction means for reconstructing the image from the two or more consecutive sub-images.

15. The radiation imaging system (30) according to claim 14 further comprising processing means for differentiating between foreground and nonuniform background in the plurality of radiation shadows such that the nonuniform background can be subtracted from the image.

16. The radiation imaging system (30) according to claim 15 wherein the processing means is adapted to replace one background with a second background.

17. The imaging system (46) according to claim 1 wherein the amplified detector (96) has a radiation-stable "dead layer" created by ion implantation.

18. The imaging system (46) according to claim 2 further comprising optic means (52) disposed within the camera housing (46) for collecting the image-bearing radiation (38) and defining the optical path, where the optic means is integral with the scintillator (50).

19. The radiation imaging system (30) according to claim 2 wherein the scintillator (50) has a density of at least 6 grams per cubic centimeter.

20. The imaging system (46) according to claim 1 further comprising:

filtering means for filtering the image-bearing radiation consecutively through a plurality of wavelength filters (40) which allows only light within a preselected ranges of wavelength to pass, so that a "colored" image can be formed using these subimages of different wavelength,

analysis means to distinguish between the changes of sub-images due to the filtering of the light of different wavelength and due to the object motion during and between the exposures, and

correcting means for correcting the changes of the plurality of sub-images due to the object motion and correlating the plurality of sub-images into a color image (Fig. 10).